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ABSTRACT

Studied were 48 retarded children, 9- to 18-years-old, (mental age 4 to 8 years) to determine effects of task screening and objectivity of protocol scoring on achievement of the concept of conservation. Results indicated no significant differences in achievement of conservation as a function of either experimental variable. Also data indicated that the percent of Ss showing conservation was significantly lower than predictions made in Greenfield's work (1966). The investigation does not provide support for the hypothesis that mentally retarded children develop the ability to conserve mass to the same degree as normal children. (MC)

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THE EFFECTS OF TASK SCREENING AND SCORING OBJECTIVITY ON RETARDATE CONSERVATION PERFORMANCE[1]

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THE EFFECTS OF TASK SCREENING AND SCORING OBJECTIVITY ON RETARDATE CONSERVATION PERFORMANCE[1,2]

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Piaget's work in cognitive psychology has led him to describe a stage in the child's cognitive development that is termed concrete operations. This period lasts from approximately 7 to 12 years of age in the non-retarded child. During the concrete operational stage the child begins to "conserve" mass, weight and volume. The concept of conservation implies that the child recognizes the maintenance of the identity and equivalence of the material involved through a series of physical transformations of the material. For example, liquid may be poured from one glass to another of a different shape or size. If the child has the ability to conserve mass, he will recognize that the amount has not changed. Further, conservation ability includes the concept of the "reversibility" of the tasks: the water may be returned to its original container without changing amount (Baldwin, 1967).

Inhelder has tested for the presence and development of conservation in mentally retarded children (Inhelder, 1968). From her results Inhelder concludes that, except for a few individuals showing "oscillations",

the mildly retarded child develops conservation concepts in the same sequences as the non-retarded child. In her opinion responses to questions on conservation given by mentally retarded children are the equivalent to those given by non-retarded individuals of the same developmental level.

Woodward (1960), working with retarded children in Piaget's sensorimotor period of development has reached much the same conclusion as Inhelder. Woodward's work indicates that mentally retarded individuals follow the same developmental sequence as non-retarded individuals although at a later chronological age (CA).

Greenfield (1966) has conducted a series of investigations with Bruner designed to explore the relationship of iconoclastic and symbolic modes of thinking in the development of conservation. Iconoclastic thinking is roughly defined as thinking tied to visual imagery. Symbolic thinking is roughly defined as the use of language. Symbolic thinking may assume a more abstract quality than iconoclastic thinking. Greenfield's subjects were youngsters of normal intelligence with CA 4 to 7 years.

In one of the Brumer studies, the child is given the "opportunity" to use the symbolic mode in solving a typical conservation task involving liquid. A screen is used to hide the differing sizes of containers into which the liquid is poured. Greenfield (1966) postulates that the child's symbolic abilities exceed his iconoclastic abilities and that the removal of the visual aspect of the task allows the child to utilize the symbolic mode. In this investigation the training (screening of the task) had substantial influence on all but the four year olds.

The proportion of five year olds achieving conservation after training more than tripled that found in four year olds from 20 percent to 70 percent. Children that are six and seven years of age also show a striking rise, nearly doubling their conservation achievement (Greenfield, 1966).

Siegel and Goldstein (1969) report a study with non-retarded children in which the question of language development level in relationship to conservation tasks is considered. The point is made that the child's concept of "full" may be equal to "not empty" without reference to proportion. To the adult, "full" is considered as a function of the relationship of amount to size of container. Further, Siegel and Goldstein (1969) suggest that the child, not understanding the task required, may give a recency response; that is, give the response that is related to the last question given by the investigator.

Unfortunately for the researcher, Piaget's observations of children have been largely subjective in nature. Where formal testing has been attmepted no standardized test protocol has been developed. Questioning by the investigator is intended to determine how the child reaches a conclusion (Inhelder, 1968) and has, therefore, consisted of leading questions and attempts to call the child's attention to his inconsistencies. Such a procedure makes replication of studies extremely difficult, if not impossible. The development of an objective protocol and scoring method would remove the subjective factor from formal testing of Piaget's scheme of cognitive development and increase investigator agreement on results. In this condition, replication would become possible.

It has been suggested that conservation of mass develops in individuals with average intelligence at approximately 7 years of age (Inhelder, 1968). Visual screening of the task has been claimed to reduce the age of conservation development for some individuals. One purpose of the present study was to determine if conservation of mass occurs at approximately the same mental age in mentally retarded individuals as in individuals with normal intelligence. A second area of interest was the degree to which visual screening of the task facilitates the development of conservation of mass. The degree of scoring objectivity was also studied in terms of its influence on the appearance of conservation.

Method

Subjects:

Forty-eight subjects, male and female, were randomly selected from a subject pool drawn from Texas State Schools. Table 1 summarizes subject MA, CA, and IQ characteristics. Individuals with severe

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Insert Table 1 about here

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emotional or health problems or with a sensory or neurological deficit were excluded from testing. Presence of these problems and deficits were determined from records and attendant and house parent reports. Subjects were randomly divided into four groups of 12 members each.

Materials:

Three beakers, two identical in size and shape, one taller and with larger diameter but identical in shape, were used. A screen short

enough to allow only the tops of the beakers to be seen and two pitchers of identical size and shape containing colored water were used. Vegetable dye (food coloring) was used to color the water yellow.

Procedure:

Two scoring procedures were employed. Protocol I (subjective scoring method) was derived from protocol samples presented by Inhelder (1968). Protocol II was formulated by E to provide an objective scoring method for conservation. This procedure did not include extended probing and used the child's first response in scoring. Responses from Ss consisted of verbal responses of "same", "more", or "less", or an equivalent by protocol standards. Presentation order of these statements relating to amount were randomly counterbalanced to control for recency responses.

Two tasks were used with both scoring procedures. Task A consisted of a conservation of liquids problem with screening (Greenfield, 1966). Task B consisted of the same liquid conservation problem performed without screening.

Results

Data were analyzed using a multiple linear regression analysis with modifications for a binary criterion vector. Results of this analysis indicated that randomization was effective on both MA and CA with no differences between groups on these dimensions ($F = 1.284$, $df = 5/33$, $P = .294$). Results also indicated that no differences occurred as a function of question order (i.e. more than, less than or same) ($F = 1.566$, $df = 4/33$, $P = .206$). Group performance did not

differ as a function of either scoring method or task screening (F = 1.566, df = 4/33, P = .296). These data indicate that MA was the sole significant predictor of S performance on the tasks (F = 2.647, df = 4/33, P = .051). Figure 1 graphically illustrates percent of Ss achieving conservation by condition.

Insert Figure 1 about here

The data were further examined using a chi square analysis to determine if the proportion of Ss exhibiting conservation was different than would be expected. Expected proportions based on chance (.50 for achievement of conservation, .50 for failure to achieve conservation) were utilized under each condition. These expectancies were considered conservative based on Greenfield's (1966) data with unexceptional children of a similar MA on a similar task. Results of this analysis indicated a significantly smaller proportion of Ss achieving conservation than expected with screening (chi square = 13.54, df = 1, P <.01), non-screening (chi square = 16.70, df = 1, P <.01), subjective scoring (chi square = 13.54, df = 1, P <.01), and objective scoring (chi square = 16.70, df = 1, P <.01). Figure 2 compares graphically the proportion of Ss achieving conservation in this study with those reported by Greenfield (1966).

Insert Figure 2 about here

Discussion

Results of this investigation are at variance with the findings of Greenfield (1966) and Inhelder (1968). Ss in this study, while the same presumed MA as Greenfield's Ss, did not approximate their performance in either the unscreened (iconoclastic) or the screened (symbolic) task. This finding is of particular interest in light of the fact that MA was a significant predictor of performance. This may suggest factors other than mental age as being instrumental in a deficit in both iconoclastic and symbolic functioning. This finding is in agreement with the results of Drew (1969) who obtained data indicating MA to be the sole significant contributer to performance differences between retardates and normals. The experimental task for Drew's (1969) investigation was considerably different than the task involved in the present study.

The present data do not support the claim that visual screening reduces the age of conservation development. These results would also seem to suggest that objectivity in scoring does not influence conservation scores on a Piagetian task. This would appear to support Inhelder's (1968) hypothesis that the amount of questioning does not influence the child's certainty of amount and identify of the liquid. It should be noted, however, that while not significant, Ss scored with the subjective protocol tended to show conservation more often than those under the objective scoring condition (Figure 1). The lack of significance on this variable may be an artifact of task difficulty since so few Ss achieved conservation.

It was expected both from Inhelder and Greenfield that some MA 6's and most MA 7's would be able to perform a liquid conservation task. This study found, to the contrary, that very few of the subjects did, in fact, attain conservation. Those who did, however, had MA's of 5.11 to 8.4. In support of Greenfield's findings however, investigators, on a subjective level, felt that language deficiencies contributed to the subjects' inability to perform the task.

Another possible explanation of the very low incidence of conservation in this study lies in Siegel and Goldstein's (1969) question concerning the child's understanding of adult language. The retarded child, not understanding the abstract meaning of "more", "less", "same", might continue responding with the first "acceptable" answer--or change answers until the investigator gives up. This suggestion also implies that language deficiencies account for much of the retarded child's difficulty with conservation tasks.

Summary

The effects of task screening and objectivity of protocol scoring on achievement of conservation were studied. Ss were 48 retarded children with mental ages from 4.9 to 8.4.

Results indicated no significant differences in achievement of conservation as a function of either experimental variable. Percent of Ss showing conservation was significantly lower than was predicted by Greenfield's (1966) work. Thus the present investigation does not provide support for the position that retardates develop the ability to conserve mass to the same degree as their mental age normal counterparts.

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TABLE 1

SUBJECT MA, CA, AND IQ CHARACTERISTICS*

Statistic	MA	CA	IQ
Range	4.9-8.4	9.7-18.5	45-72
Mean	6.7	13.0	50

*IQ measures were primarily obtained using the WISC with the exception of three subjects who were tested using the Stanford-Binet Form LM.

Figure 1

Subjects Achieving Conservation by Condition

C = Conservation

Sc = Screening

N/Sc = Non-Screening

S = Subjective

O = Objective

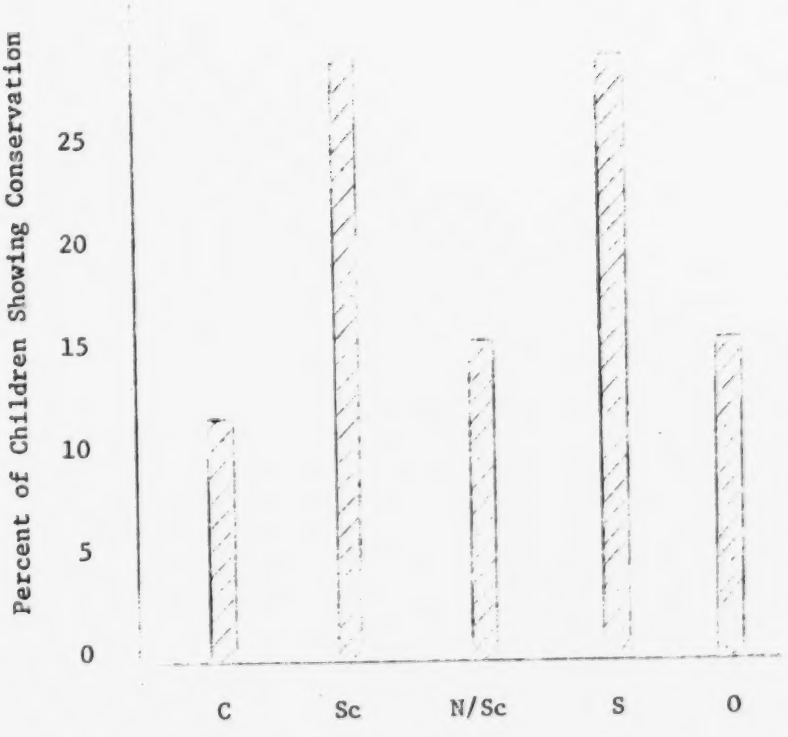

Figure 2

A Comparison of Present Results with those of Greenfield